CLAIMS:

1.   A method of generating a representation of the compositional distribution of a chemical sample as a function of depth, comprising:

        irradiating the sample with radiation having a plurality of frequencies in the range from 25GHz to 100THz;

        detecting radiation reflected from and/or transmitted by said sample to obtain a time domain waveform;

        obtaining frequency data as a function of time from the time domain waveform;

        deriving the representation from the frequency data.

2.   A method of generating a representation of the granularity of a chemical sample as a function of depth, comprising:

        irradiating the sample with radiation having a plurality of frequencies in the range from 25GHz to 100THz;

        detecting radiation reflected from and/or transmitted by said sample to obtain a time domain waveform;

        obtaining frequency data as a function of time from the time domain waveform;

        deriving the representation from the frequency data.

3.   The method according to any preceding claim wherein the sample is a pharmaceutical sample.

4.   The method of any preceding claim wherein frequency data as a function of time is obtained from the time domain waveform using a Gabor transform.

5.   The method of claim 4 wherein the Gabor transform is implemented using a windowed Fourier transform, a correlation of a specific kernel function or a filter-bank.

6.   The method of claim 4 or 5 further comprising applying the Gabor function to the time domain waveform and selecting frequency, window type and/or window width of the Gabor function to optimise spectral or temporal features.

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7. The method according to any preceding claim wherein the compositional distribution representation is a three dimensional representation.

8. The method according to any preceding claim further comprising:

subdividing the sample to be imaged into a two-dimensional array of pixels, detecting radiation from each pixel;

obtaining a time domain waveform for each pixels; and

obtaining frequency data as a function of time for each pixel from the respective time domain waveforms;

deriving a representation as a function of depth at each pixel from the respective frequency data; and

combining the representations for each pixel into a three dimensional compositional distribution representation for the sample.

9. The method according to any preceding claim further comprising:

subdividing the sample to be imaged into a two-dimensional array of pixels, detecting radiation from each pixel;

obtaining frequency data as a function of time for each pixel from the respective time domain waveforms;

deriving a cross-sectional compositional representation from the respective frequency data.

10. The method of any preceding claim wherein the radiation is pulsed.

11. An apparatus for creating a three dimensional compositional distribution representation of a chemical sample, the apparatus comprising:

emitter for irradiating the sample with radiation having a frequency in the range from 25GHz to 100THz;

detector for detecting radiation reflected from and/or transmitted by the sample at a plurality of pixels and producing a time domain waveform for each pixel;

means for obtaining frequency data as a function of time from the time domain waveform for each pixel;

means for deriving a compositional representation as a function of depth from the frequency data for each pixel; and

means for combining the representations for each pixel to generate the three dimensional compositional distribution representation.

12.   The apparatus of claim 11 wherein the sample is a pharmaceutical sample.

13.   The apparatus of claim 11 or 12 wherein the means for obtaining frequency data obtains the frequency data by applying a Gabor transform to the time domain waveform for each pixel.

14.   The method according to any one of claims 1 to 10 as used in a pharmaceutical manufacturing process.